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Journal

Land

6

Winds of change

Why the offshore sector must get used to decommissioning first-generation turbines

The *Land Journal* is the journal of the RICS Environment, Geomatics, Minerals and Waste, Planning and Development and Rural Professional Groups

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Technology

‘Technology is all-pervasive and global, so traditional land surveyors have had to evolve swiftly – and not without difficulty’

James Kavanagh
Global land standards director, RICS

Land Journal has consistently emphasised the link between developing technology and effective land administration — and, by extension, the financial and taxation advantages implicit in this relationship.

This might seem like a marriage of different basic concepts and processes. Technology, especially geospatial technology, is strictly objective, with systems designed to eliminate and control errors. Then there is land itself, a critical asset of immeasurable value and importance but with the added complexity of subjective human ownership, identity, conflict and law, as well as the intricacies of ecology.

Land, and its ownership, management and stewardship, is core to several major UN global initiatives. In its broadest context, land is also key to global economic development and political stability. The recent peace in Ethiopia and Rwanda and related economic development, for instance, are grounded in appropriate land formalisation initiatives.

Valuation is another core element of effective land administration, and is a mixture of objective and subjective philosophies. It is key to land-based financing, taxation and compulsory acquisition, and establishing value can add weight to the recognition of legitimate ownership rights and tenure security.

This may seem counter-intuitive, but it has been successfully argued at World Bank land conferences that valuation and the establishment and payment of a basic land or property tax for services can be proof of legitimate ownership during disputes.

RICS’ research paper *Valuing unregistered land* provides an evidence base for initiatives such as the International Land Measurement Standard, the Global Land Tool Network’s *Valuation of unregistered lands: A policy guide* and the UN Food and Agriculture Organization’s *Valuing land tenure rights*, as well as future initiatives such as developing environmental and ecosystem valuation standards and the International Valuation Standards.

Traditional land surveyors have had to evolve swiftly. A recent UK geo-economics report highlighted a year-on-year increase in revenue of 12 per cent in this sector (*bit.ly/CW-lms20*). Yet the recent debate about whether geospatial technologies are suitable to kick-start tenure formalisation and revenue generation has stalled, with issues over legal verification of ownership, geospatial capability and professional capacity forcing several developing nations to look to legislative change rather than technological revolution.

As land and property information becomes more transparent and accessible, effective administration systems become more entwined with geospatial technology and valuation. Valuation is also evolving from western market concepts — which only work properly when comparable information is openly available — to become more inclusive and technology-driven. For instance, map-based valuation models, blockchain and valuation methodologies are perfect for artificial intelligence.

Effective land and property taxation and revenue generation are directly connected to functioning land administration systems and are shockingly low in developing nations. In such countries, the potential contribution of land-based financing to the development of sustainable and equitable cities and properly serviced communities is often not fully realised. When land and property data become transparent then professionals can feel exposed, and when government policy seeks to drive down asset value then technology steps in.

Effective land administration systems are vital for high-, medium- and low-income nations and the application of geospatial technology, valuation and land tenure formalisation are critical for the success of systems that seek to enable and implement government policy and initiatives on climate change and economic development. This creates an exciting future for land surveying — but one that requires us to think more holistically about land.

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Briefing

Keep up to date on RICS' COVID-19 response

During the COVID-19 outbreak, RICS is closely monitoring developments and following official advice to ensure we continue to support the profession. We encourage all members and member firms to visit and bookmark *rics.org/coronavirus*, which RICS is updating regularly. The page includes:

- resources for candidates and professionals, with online CPD free until July
- guidance on key concerns and risks, including dispute resolution, inspections, personal indemnity insurance, planning, support for SMEs, valuations and more
- news and insight
- responses to frequently asked questions.

Any queries or concerns not dealt with on the site should be directed to *covid19@rics.org*.

RICS continues to develop profession

Recent issues of *Modus*, *Construction Journal* and *Property Journal* offer updates on the direction that RICS is taking the profession forward in the areas of standards, training, regulation and tech and data at a time when traditional routes to qualification are being challenged and lifelong learning is increasingly important.

For the full story, see *Modus: The Future Issue* (pp.22–26), *Construction Journal* April/May (pp.10–11) and *Property Journal* May/June (pp.18–19).
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Future *Land Journals*

Because of long lead times, anything we publish about the virus or its implications in the journal will likely be out of date before it reaches you. If there's any content you would like to see included related to the impact the virus is having on our professions, please let me know and we may be able to publish more reactive pieces on the RICS website.
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Profession urged to take lead on key issues

Picking up the sustainability discussion of RICS' Value the Planet campaign, Gillian Charlesworth of the Building Research Establishment urges surveying professionals to collaborate on safety, carbon reduction, waste, resilience and air quality in the recent *Built Environment Journal* (April/May, p.5).
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rics.org/coronavirus

RICS Planning and Development Conference 2020
5 May
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Wind down

With first-generation offshore wind farms coming to the end of their active lives, what is the best way for operators to decommission them?

Eva Topham

Since the first offshore wind farm was built in 1991 in Vindeby, Denmark, the industry has focused on the development and growth of the sector, giving little thought to the end-of-life phase for turbines. Most are designed and certified for a 20–25-year service life: nearly 30 years after Vindeby, only five projects have been decommissioned, and this has been done by trial and error because there are still no clear guidelines or regulations. To date, this has resulted in lengthy, expensive processes.

Decommissioning should be considered in the design phase of projects so that structures may be easily disassembled at the end of their life, and to ensure that the funds are available to decommission them. Numerous factors make decommissioning a challenge, such as:

- the hostile marine environment
- the difference between the estimated and actual turbine life
- the technical restrictions of vessels
- the absence of dedicated regulations
- the need to plan decades in advance.

Because each site is unique, every project will need to be decommissioned in a different way. End-of-life decisions will be critical in the next few years as around 20,000 offshore wind turbines will reach the end of their originally planned service life between 2030 and 2040. Owners need to decide whether to extend the asset's life by repowering the site — which can range from refurbishing or replacing components to installing new turbines, while trying to re-use as much of the existing infrastructure as possible to reduce costs — or decommissioning. The decision will be highly dependent on the condition of the assets as well as economic constraints: maintenance costs may be high enough to make it less profitable or even unfeasible.

Decommissioning process

Because of the lack of spare parts and the rapid upscaling of turbine size and numbers, decommissioning is often the preferred option. There is no one solution or established process, but reducing time, costs and environmental impacts are the main considerations. The lifetime of turbines is also crucial: if projects do not perform as predicted, this will have a considerable impact on the economics of the project and its decommissioning plan.

The availability of specialised vessels is another crucial factor. The variable price of oil makes predicting future vessel costs challenging. Even if oil prices stay low, future demand for such vessels will remain high because they are solicited for oil and gas decommissioning as well as the installation, operation and maintenance, and decommissioning of offshore wind.

Minimising the length of the operations is important to reduce costs, but the time taken for the process will vary with the type of vessel chartered, the disassembly technique and the number of lifts used, as well as the transportation strategy. Water depth is a key factor, because deeper water requires longer monopiles, which makes operations more difficult and will have a direct impact on the foundation design and weight of the project to be decommissioned. In addition, these processes rely on good, consistent weather conditions.

The UK Department of Trade and Industry initially estimated the cost of dismantling offshore wind turbines as £40,000/MW, but recent studies show it can exceed £200,000/MW. To reduce this, vessels should be chartered in advance and there should be a clear strategy, including what to do with components once removed.

Even though prioritising reduction ahead of re-use and only then recycling should be the aspiration, the two main scenarios for offshore wind turbines are recycling and, if this is not possible, disposal. Most turbines installed to date are gearboxed, mainly comprising metals such as steel, cast iron

This turbine at Egmond aan Zee offshore wind farm in the Netherlands, installed in 2006, is one of the 1,800 due to reach the end of their lives by 2030

and copper, which are used in the tower, gearbox, main shaft, generator, castings, bearings and parts of the nacelle and hub. This means that nearly 95 per cent of the total weight of turbines could be recycled.

Most foundations are monopiles, which are also made of steel and embedded into the seabed. Therefore, decommissioning involves cutting a few metres into the seabed and lifting the piles out. Where offshore wind turbines sit on monopile foundations, a recent study showed that if everything were recycled, decommissioning costs could be reduced by 20 per cent. However, this figure is highly dependent on the current scrap metal price, which is volatile. Disassembling the structures into all the distinct components is challenging.

The remaining five per cent can be found in the power electronics, lubricant and cooling substances, and polymers that are mostly used in the blades. To date, blades remain problematic to recycle and they are mostly shredded, incinerated or go to landfill. Research around this continues because of the number of turbines, both onshore and offshore, that will need decommissioning in the next few years.

As turbines continue to increase in size and capacity, there will be a transition to direct-drive turbines, which do not require gearboxes, and this is supposed to reduce failure rates as well as operation and maintenance costs. In addition, as turbines become larger more raw materials are being used. Two smaller turbines need fewer raw materials than a single large turbine of the same rated power, so even though larger turbines would produce more and should be more competitively priced, using increased resources for the same capacity makes them unsustainable. This makes recycling and re-using raw materials essential.

Before decommissioning, companies should consider all options: both partial and full repowering, which generally depend on the status of the asset and the technical limitations of any new turbines being installed on the foundations, or the electrical system being re-used. This approach supports a flourishing market offering second-hand components and even turbines at a reduced price.

Once the asset stops operating, the owner is required to leave the site as it was before the project was installed to prevent environmental damage. However, because the regulations are unclear, there is an argument for leaving the structures in situ as new marine habitats may have flourished around them and the environmental impact may be increased if they are removed. This would also benefit the project owners by reducing their decommissioning costs. Safety conditions apply — for instance, cutting the foundations to allow secure navigation, ensuring that cables are well buried and so on. If owners do not estimate their decommissioning costs realistically, the worst case could be that they abandon the project leaving the public to pay the bill.

Decommissioning is a complex procedure full of uncertainty, and currently challenging because of the sector's limited experience and lack of specific regulations. Detailed regulations and guidelines with clear liabilities for the owners are necessary to minimise impacts, as well as encouraging sustainable decommissioning from the design phase that targets re-use and recycling of materials.

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The robot revolution

Crop robotics can help cut the costs of farming while bringing previously unused land into use, recent research has shown

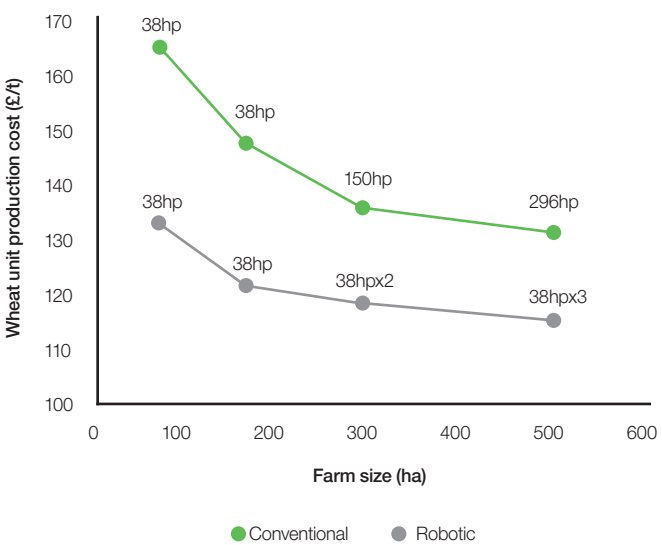
James Lowenberg-DeBoer and Simon Keeble

Crop robotics are coming soon to a farm near you. Retrofit kits to convert conventional equipment for autonomous use are already being marketed in several countries. In the next few years several UK start-up companies have plans to commercialise robots designed for farm use. Those robots have the potential to change the management of rural land in the UK.

With tractors, combined harvesters and other conventional mechanisation, the economic rule of thumb is that bigger is better – but when human operators are removed from the equation the need for ever-larger equipment almost disappears. On the farm of the future, crop operations are likely to be accomplished by a swarm of smaller machines on small, irregularly shaped fields, with woods, wetlands and other non-arable areas being farmed by robots almost as efficiently as large, flat, rectangular fields.

This large-scale shift to autonomous crop equipment is poised to occur in the next five to ten years. Most major farm equipment companies have autonomous equipment research and development programmes, and there are some 45 start-up companies around the world focusing on robotic farm technology. A kit to convert conventional equipment to autonomous use is already being marketed in the USA. The transition to crop robotics will create demand from landowners, farm tenants and farming enterprises for advice on how best to adapt their businesses; for example, tenancy agreements will need to be modified to reflect changing costs and production potential.

Figure 1. Comparison of farms with conventional and autonomous machines across a range of sizes; x2 and x3 indicate sets of autonomous machines under robotic farming



The new agricultural revolution

The Hands-Free Hectare (HFH) project at Harper Adams University has shown that it is technically possible to produce arable crops in the UK with autonomous machines. Researchers are using HFH to provide a glimpse of the implications of crop robotics for farm management, including the following.

- The farmland price premium for large, flat, rectangular fields will be reduced because small robots can farm small, irregularly shaped fields efficiently.
- Small robots put less weight on the soil than large equipment, which means less soil compaction, better soil health, and potentially more days for field operations, because small machines may work when soils are too wet for conventional equipment.
- There will be an increase in hedges, copses, unfarmed sandy patches and other natural areas that provide habitat for wildlife and predatory insects as the capacity of robot swarms to farm efficiently around these areas allows more ecological balance.
- Weeding robots use lasers, electrical weed zapping and mechanical control, potentially reducing the need for pesticides, which makes profitable organic crop production more feasible.
- Farming in peri-urban areas will be possible because of reduced reliance on pesticides, and the smaller equipment that can be moved from field to field more easily in heavy traffic.
- Farming with robots can reduce production costs, increase

yields and adapt practices to accommodate consumer preferences. Those changes affect comparative advantage and trade: for the past century, countries with large, flat rectangular fields such as Argentina, Australia, Brazil, Canada and the USA that can be farmed efficiently with conventional equipment have had a comparative advantage in grains and oilseeds. In the future, this advantage may pass to countries with good soil and reliable rainfall that are close to consumer markets, and where production practices fit consumer preferences in spite of their fragmented landscape, such as the UK.

HFH uses conventional small- and medium-scale farm equipment retrofitted for autonomous operation. Starting with a flat, square, 1ha field on Harper Adams University farm in 2017, two years later it was scaled up to a 35ha hands-free farm that will test the equipment under typical UK agricultural conditions.

Until HFH, little public data has been collected on the farm management implication of crop robotics. Although several agribusinesses are developing autonomous equipment, their data is proprietary, while many universities and research institutes worldwide with prototype crop robots have little experience producing crops at a commercial scale.

In contrast, the costs and returns from an HFH-type farming system are relatively easy to estimate. Because HFH uses retrofitted conventional farm equipment, the cost, reliability, repair expense, useful life and other machine characteristics are well known. HFH documented retrofit costs based on commercial global navigation satellite systems (GNSS) guidance and modified open-source drone software. The input requirements, field operations and yields for the commercial crops produced are also well documented.

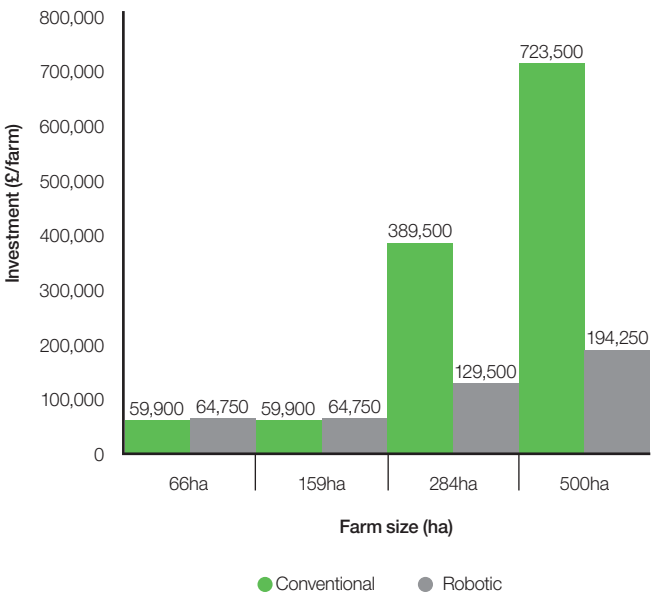
Modelled machinery

To extrapolate the HFH experience to farm level, agricultural economists used standard farm management information to develop a simple whole-farm linear programming model for a grain farm in the West Midlands that was direct drilling winter wheat, oilseed rape and spring barley. A range of farm sizes were modelled with the HFH equipment as well as three conventional options.

For example, the HFH robotic tractor was 38 horsepower (hp), whereas the conventional equipment options had tractors rated at 38hp, 150hp and 296hp as farm size increased. Key results from that analysis include the following.

- Figure 1 shows that crop robotics has the potential to cut the cost of grain production depending on the farm size. For the smallest farm, the cost of wheat production was reduced from £166/t to £133/t. For the 500ha farm, the wheat production cost was reduced from £131/t to £115/t.
- The estimated cost curves in Figure 1 show that robotic grain production can approach minimum costs on smaller scale of farm than conventional equipment. At 500ha, costs using conventional equipment were still dropping, but the robotic model is approaching minimum costs on the 159ha farm. For larger farms, the robotic farm adds further HFH equipment operating as a swarm of machines.
- Figure 2 shows that, on medium and larger farms, robots can substantially reduce capital costs because they enable smaller

Figure 2. Estimated equipment investment for conventional and robotic farms over a range of farm sizes



equipment to be used more intensively. On the smaller farms, of 66ha and 159ha, equipment investment is slightly higher than on the conventional farm because of the GNSS guidance and software that is required.

Some key assumptions in this analysis include:

- farmers own rather than lease or rent the robotic equipment
- human supervision of the autonomous equipment can be done remotely, for instance by checking a mobile app, rather than requiring the physical presence of a human operator in the field
- insurance costs and conditions for the robotic farm are comparable to conventional farms.

As the hands-free farm expands and provides new information, the research team plans to refine this analysis to examine the impact of field size, shape and topography, extend the analysis to assess a broader range of farm sizes and crops, and consider the impact of automation for larger-scale equipment.

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Cleaner, greener growth

Climate change will need to be a high priority in the planning system if emissions targets are to be met and resilience ensured

Amanda Beresford

The UK government last year committed to reducing greenhouse gas emissions to net zero by 2050. At a local level, many councils have set even tougher targets. Bristol and Leeds City Councils both have targets for net-zero carbon by 2030, where any emissions would be balanced by absorbing equivalent amounts from the atmosphere. Nottingham City Council meanwhile has a carbon-neutral target for 2028, so that while some carbon could still be generated it would be offset elsewhere and overall net emissions would be zero; and Manchester City Council plans to be a zero-carbon city — emitting no carbon at all — by 2038.

It is unlikely that these targets can be achieved without significant changes to the planning system. Policies will need to focus on ensuring developments are as energy-efficient as possible, encouraging the installation of the infrastructure needed for a low-carbon economy and directing the location of new development to maximise walking, cycling and public transport.

A more resilient future

As well as carbon reduction targets, many councils are also planning to increase resilience to climate change in their jurisdictions, dealing with measures such as flood defences. They have a legal duty under section 19(1A) of the Planning and Compulsory Purchase Act 2004 to ensure that climate change mitigation and adaptation are core objectives, integrated across all local planning policy, and they will probably seek to apply this more robustly than in the past. Consequently, it is also likely that they will not readily, if at all, plan or grant planning permission for anything that does not demonstrably contribute to a net-zero carbon emissions future and resilience to climate change.

The provisions of the government's National Planning Policy Framework (NPPF) are material considerations that a local planning authority must consider when determining planning applications. These provisions are also referred to by inspectors and the secretary of state for housing, communities and local government in determining planning appeals.

Future revisions to the NPPF are likely to include more stringent requirements on combating emissions, and the framework's current policies on climate change are likely to be more rigorously applied. But at present, the NPPF already aims to ensure:

- a proactive approach to mitigating and adapting to climate change

- consideration of the long-term implications of not dealing with the issues, including the increase in flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures
- development plans that help to increase the use and supply of low-carbon and renewable energy and heat
- appropriate measures to support the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures or supporting the possible future relocation of vulnerable development and infrastructure
- new developments avoid increased exposure to the impacts of climate change and help to reduce greenhouse gas emissions, by being appropriately located, oriented and designed; they must also take account of land form, layout, building orientation, mass and landscaping to minimise energy consumption
- compliance with policies to preserve and enhance the natural environment.

Recent amendments to the NPPF have included a requirement for biodiversity net gain meaning that, when building new housing or commercial development, any wildlife habitats that are affected must be enhanced and left in a measurably better state than they were beforehand. This requirement is about to become law in the current Environment Bill.

Local development plans drawn up by councils influence land use and development in an area, including housing, commercial buildings and energy infrastructure, all of which will have an influence on a council's carbon reduction target and climate change resilience plans. Such development plans need to comply with the NPPF and are referred to when determining planning applications.

Section 70(2) of the Town and Country Planning Act 1990 and section 38(6) of the Planning and Compulsory Purchase Act 2004 provide that, to the extent that development plan policies are material to an application for planning permission, the decision must be taken in accordance with the plan unless there are material considerations that indicate otherwise.

The viability of some developments may mean hard choices have to be made

This statutory provision also applies to planning appeals. Many local development plans have already been adopted by councils in advance of setting their carbon reduction targets. Plans may therefore have to be revised, or at least redirected in the way they are applied, to increase the weight given to policies that deal with climate change.

Planning ahead

Other requirements are also likely to be referred to in the planning decision-making process. For example, the independent Committee on Climate Change, which advises the government, has recommended that no new homes be connected to the gas grid from 2025, so future decisions on applications for planning permission, including for residential development will have to take this into account.

Councils are therefore likely to strengthen requirements to deal with climate change when drawing up local development plans and determining planning applications. This will include:
- placing greater emphasis on co-locating uses, and planning development near public transport links to reduce car travel
- encouraging use of renewable energy, such as solar and wind
- setting more ambitious targets on energy efficiency in buildings
- embedding and prioritising climate change in local plan-making and determining planning applications
- requiring travel plans with increased sustainable transport obligations, prioritising walking, cycling and public transport over car use, and electric vehicles over diesel and petrol.

These factors are also increasingly likely to be prioritised by inspectors when determining planning appeals in the future.

There will undoubtedly be challenges. The issue of which standards local planning authorities can apply to new buildings in the context of achieving climate change targets continues to be debated.

The viability of some developments may mean hard choices have to be made, for instance where a residential scheme cannot support both the cost of providing a significant percentage of affordable housing as well as installing energy efficient measures into those homes. In some cases, it may also be appropriate to reconsider green belt boundaries, for example where a new settlement would be the best opportunity to create a low-carbon, climate-resilient community.

There will also be opportunities in the green economy. If the planning system is to bring forward more energy-efficient construction methods and buildings, the market will need to respond with better products and methods; and if planning is to step up the installation and use of renewable low-carbon energy, the market will need to step up innovation.

Dealing with climate change will need to be a high priority for the planning system if emissions targets and climate change resilience are to be achieved, and all landowners, developers and designers of building products and transport energy infrastructure as well as innovators will have to play their part.

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What's the big deal?

The Land Matrix Initiative is documenting large-scale acquisitions to ensure that local communities are not missing out

Cecilia Coccia, Angela Harding and Danya-Zee Pedra

Soaring food and fuel prices and the instability of global financial markets have prompted agri-businesses, investment banks, and food- and energy-hungry nations to secure resources in countries where land is available, or is made available, for investment. Given that access to land is closely linked to food security, poverty alleviation, sustainable livelihoods and rural transformation, and that large-scale land acquisitions (LSLAs) can hinder such access, it's important to monitor these deals.

However, the controversial context and the complexities of LSLAs, as well as their potential to create conflict, mean that deals usually take place behind closed doors, limiting access to data and information on tenure. In addition, weak and deficient land and economic governance practices — largely related to this lack of information and transparency — often create conditions that fail the rural poor and disadvantage local land users in decisions on land and investment. This can weaken their position in the process, and may mean they are not being fairly compensated.

'The global impacts of LSLAs are substantial, and while potentially positive impacts are relevant, including increased investment in developing economies … negative impacts are a serious concern, and generally impact the poor most directly,' explains Markus Giger, chair of the Land Matrix Initiative (LMI). Such negative impacts can include displacement of rural people and dispossession of land and other resources, biodiversity decline, forest loss and increasing marginalisation of local farmers in land and commodity markets.

Transparency and accountability

Availability of reliable, up-to-date data is crucial to understand the context in which LSLAs take place and to improve evidence-based decision-making. The Land Matrix was therefore established in 2009 to keep track of these deals in a systematic way, and make the data open and easily accessible. A partnership of nine global and regional organisations, the Land Matrix is an independent monitoring initiative that promotes transparency and accountability in decisions over LSLAs in low- and middle-income countries around the world.

By collecting and sharing data about land deals on its open-access platform, the initiative aims to stimulate debate on the trends and impacts of such acquisitions and, in so doing, contribute to strengthening the positions of more vulnerable stakeholders in the political and administrative processes that govern access to land.

Transparency on compensation and benefits promised and received, as well as other variables such as displacement and community impact, is generally very low, even though it is increasingly accepted that data ecosystems — infrastructure, analytics and applications used to collect and analyse data on land and investment — are necessary for more inclusive, open and rigorous monitoring of land governance. In the land sector, data is scattered, often focusing only on certain markets and tenure regimes, and is politically sensitive.

The first version of the Land Matrix database, launched in 2012, gave an overview of large-scale agricultural investments. It has since evolved to include the Global Observatory, which illustrates the magnitude of LSLAs on an international scale; country-specific data provides a critical regional lens on these activities. Using the online platform, you can filter the deals by negotiation and implementation status, including intended, concluded, and failed attempts to acquire land through purchase, lease or concession. Deals may also be filtered by proposed uses, which range from agricultural production, timber extraction, carbon trading, industry, and renewable energy production to conservation and tourism.

Decentralisation is fundamental for fostering wide participation in the collection and sharing of information about LSLAs, contributing to open development and greater public involvement in critical decisions that affect land users. By piloting and supporting national land observatories (NLOs), the initiative was able not only to launch activities at country level but also to lay the foundation for continuing information sharing and dialogue in existing, multi-stakeholder platforms and to influence policy at national level.

Multi-stakeholder platforms also bridge the gap between those contributing to research on LSLAs, including researchers, civil society organisations, non-governmental organisations, and community leaders, and those that will use data to inform policy, such as governments. Bringing these parties together in pursuit of a common objective is a constructive way to connect them and enable better decisions on land and land investments.

Nevertheless, collecting information about land deals remains difficult. The

To date, the Land Matrix has recorded

2,039
deals

1,729
deals have been concluded

More than
79.8m
hectares are included in all deals

Deals on
49.6m
hectares have been concluded

Deals have been documented in more than
85
countries

IMAGE © CDE/JULIE ZÄHRINGER

Demonstration against the Kaliwa Dam in the Philippines. LMI was among the agencies that compiled advocacy maps for indigenous people to show how their area would be affected by the project

Case study

The regional focal points (RFPs) and national land observatories (NLOs) investigate the social and environmental effects of LSLAs, feeding this data into advocacy strategies, which can help mitigate such phenomena in favour of more equitable access to land for peasants and indigenous communities. Furthermore, they engage with local communities and community-based organisations for data collection and verification.

In Argentina, for example, the Latin America RFP's collaboration with the Provincial Movement of Small Producers of Santa Fe, which brings together 34 peasant and indigenous organisations, resulted in the passing of Law 13666 prohibiting evictions throughout the province of Santa Fe, as well as the mobilising of resources to survey and map land to regularise land governance and secure territorial rights for peasants and indigenous peoples.

As valuable as the global perspective is for providing a broad overview of the extent, regional pattern, and implementation of such land deals, it is equally important to understand the rich local context of LSLAs, made possible through the establishment of RFPs and NLOs, which allow the Land Matrix to improve data quality and better document relevant national specificities and developments.

For example, while deals must cover a minimum area of 200ha or larger to be included in the Global Observatory, for smaller areas at regional and country level the minimum is 50ha. This is significant when considering that, for instance, 10ha is generally the maximum amount of land for family farms in Africa, which start at around just 0.5ha, compared to the 1.58m ha – an area the size of 2.2m football fields – that is currently being used in the region for palm oil concessions alone. Another area where national data is crucial is for recording domestic deals, which would not be reflected in the Global Observatory but play a key role in many regions. The Land Matrix currently supports five pilot NLOs in Argentina, Cameroon, the Philippines, Senegal and Uganda.

information is hard to find, and even harder to confirm through independent sources. In addition, the opaque nature of land acquisitions imposes certain limits on the data-gathering process. Although private and governmental investors are beginning to share more information on land deals, transparency is still not the norm, and we continue to face a major challenge in complementing global data with local data.

Some ways we can overcome this include:

- building stronger, more sustainable and more effective connections among the various stakeholders
- using open land data to better understand the impact of land acquisition and inform intervention management
- involving existing local landholders in negotiations over land deals based on free, prior and informed consent
- leveraging open land data on land deals to advance community-based tenure through lobbying, national legislation, administrative and institutional capacity building, and implementation of inclusive and sustainable land tenure and policy
- maximising existing reference points such as the Sustainable Development Goals, the Voluntary Guidelines on responsible Governance of Tenure of land, Responsible Investment in Agricultural and Food Systems, and the Framework and Guidelines on Land Policy in Africa
- monitoring land deals, scrutinising government contracting practices, and fostering public participation in land contract negotiations through advocacy,

which are some of the core activities of the Land Matrix's NLOs, particularly with regard to the processes and dynamics of land acquisitions on the ground.

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IMAGE © LAND MATRIX ASIA REGIONAL FOCAL POINT

Growing underground

A ground-breaking company has established a hydroponics farm in a disused air-raid shelter 33m below Clapham where it grows greens sustainably

Richard Ballard

Q: How did you get the idea for the business?
RB: I used to import teak garden furniture from South-East Asia, and became interested in sustainability in the late 1990s. When I moved to London and met an old friend, LEDs were just coming on to the market, hydroponics had been around for a long time, and there was redundant urban space, so we brought these together. Neither of us had a farming background, so we joined forces with Chris Nelson who had 35 years' experience of growing hydroponics.

Q: How is the project different to traditional farming? And to other indoor farms?
RB: We don't use any pesticides, we recirculate water, and we are less than a mile from New Covent Garden Market, which distributes food around the country. We are effectively giving customers a longer shelf life and reducing food waste.

Indoor farming is all about saving space and growing more with a smaller footprint. The long thin structure of the tunnel works well for us: we can keep an eye on the products, which are only stacked four high, without any machinery to lift us up to inspect.

We currently grow leafy greens, baby leaves and micro greens using entirely artificial light. It is not yet profitable enough to grow heads of lettuce, soft fruit or peppers in the UK.

LEDs produce heat and light so we can maintain the tunnel at 23–25°C year-round, the ideal temperature for the crop, without heating it. We use dehumidifiers too, to control the environment perfectly. Grown above ground pea shoots would have three to four harvests per year, and in a greenhouse 25–30 – but we get 60.

Q: Are the premises bought or leased?
RB: We lease the space from Transport for London very cheaply. It works out as about £10/m², and we are exempt from business rates.

Q: What about your carbon footprint?
RB: We are working towards being carbon-neutral. We use redundant urban space, we don't use any pesticides, we grow close to the point of consumption and we use less water, so we are compiling all that information to work out our carbon footprint.

Q: What is the optimum scale of the business?
RB: At the moment we have 6,038m² and 500m of growing space, and we plan to expand into the rest of the tunnel. We are also looking at other sites to scale up.

Q: How is the business funded?
RB: We initially crowdfunded £650,000, and with several subsequent rounds of investment have raised £2.3m. We are still looking to finance the next phase of 2,000m², which is the scale where it should really start to be profitable.

Q: What are the next steps for the business?
RB: We've worked with the University of Cambridge's Department of Engineering since we started, which has been monitoring the temperature, humidity, air flow and carbon dioxide, and we are developing a model that will help us understand the environment before we build future sites.

We will be able to predict the optimum thickness of the walls, radiant heat and convection heat as well as the balance of all these factors. From this we will create a transfer model, so for a given building and equipment we could work out how many LEDs we would need and get an accurate idea of how we should operate there, whether it's another tunnel or a warehouse.

Data is key: we already have the perfect environmental recipe for growing, say, coriander, and the composition of light, how much from the red spectrum and how much from the blue, to create the perfect crop.

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Related competencies include: Agriculture, Sustainability

Stumbling blocks

How can large-scale land acquisitions be carried out in Zambia without disadvantaging local communities?

Dr Andrew Chilombo

Global crises in finance, food, environment and energy over the past decade have led to large-scale land acquisitions (LSLAs) in the global south — which have sparked debates about their socio-economic and environmental impacts.

LSLAs' proponents cite benefits such as:

- enhanced food security
- clean energy
- job creation
- rural infrastructure development
- broadened tax base
- eco-tourism.

Their opponents are concerned about:

- the fate of local communities
- land dispossession and involuntary displacement of local people
- environmental degradation
- local food security and sovereignty becoming compromised
- casualisation of jobs
- less access to water.

LSLAs are not new, but the current wave is specific in four main ways. First, LSLAs are happening in a highly connected global capitalist network, not within the national borders under individual states' control.

Second, development institutions such as the International Monetary Fund, the World Bank Group, the Organisation for Economic Corporation and Development and the World Trade Organization are playing a big role in promoting LSLAs by arm-twisting host countries to liberalise economic policies and encourage investments.

Third, LSLAs give investors access to global market shares to the detriment of already financially constrained smallholders in host countries. Finally, host country governments are enabling access to land as they liberalise investment policies, particularly agricultural policies.

The convergence of these four factors partly explains the two preferred modes of investing in land: low-risk direct land investments that purchase or rent land from landowners by an established operator; and, indirectly, high-risk purchase and control of a stake in an agricultural company to increase its value. The latter investments can also involve land acquisition.

One way to invest in land is through a public—private partnership (PPP), where government agencies and private entities collaborate. Each partner contributes to setting goals, planning and decision-making and allocating resources, risk, benefits and accountability. They collaborate to promote economic growth and poverty reduction as public goods. However, the success rate for agricultural PPPs is low because of:

- the different incentive structures in public and private sectors
- prohibitive costs, both direct and indirect
- the negative perceptions between the public and private sectors
- the high levels of competition and risk that are associated with valuable resources and assets.

PPPs as collaborative arrangements, responding to crises such as food, finance, environment and energy, raise ideological and operational concerns. While host governments need to boost the economy through investments in land, they lack capital and expertise. Although the private sector can offer this where it will increase profits, an LSLA PPP contract is likely to be challenging because investors perceive state agencies as slow, inefficient, and resistant to change. In LSLA deals, there is not only a willing seller and willing buyer, but many others, particularly multinational financial institutions, playing their role to encourage policy changes in host countries to enable private investments.

LSLAs in Zambia

The 1975 Lands (Conversion of Titles) Act prohibited the sale of land in Zambia. However, the Lands Act 1995 repealed the earlier legislation and allowed land tenure to be converted from customary land to leasehold. In 2002, the government decreed that nine farm blocks would be established in which 967,750ha of customary land would be converted to leasehold.

This farm block programme was modelled on contract farming. Each farm block was parcelled into the core venture — the largest parcel of the farm block for an agri-business — as well as commercial farms, medium farms and smallholder farms. Nansanga in central Zambia is one such block where smallholder, medium-sized and commercial farms were meant to produce crops to sell to an agri-business occupying the core venture. The agri-business would then export these in the sub-region and overseas.

After converting customary land to leasehold, building roads and three dams, and issuing title deeds to would-be users of commercial and medium-sized farms, Nansanga has not gone into operation. Developed infrastructure has crumbled, and the core venture has not been occupied by any agri-business. This is largely attributed to the death of president Mwanawasa in 2008 and the change of government in 2011, which did not have the same agricultural policy as the previous administration.

Before investing in Zambia, it's important to understand resources and the land tenure system. Since 1991, when the presidency of Kenneth David Kaunda ended, Zambia has been promoting pro-foreign investor

policies and conditions, including the abolition of price controls, liberalisation of interest rates, abolition of exchange rate controls, 100 per cent repatriation of profits to investing nations, free investment in virtually all sectors of the economy, privatisation of state-owned enterprises, and trade reforms aimed at simplifying tariff structures.

The land tenure system comprises two main components: customary land under traditional authorities, and state land managed by the commissioner of lands, on behalf of the president. These arrangements co-exist with different management structures. There are seven generally acceptable pathways of acquiring land in Zambia: five through formal institutions and two through traditional authorities.

The practice is that the socio-economic and financial status of the individual or organisation influences the pathway to acquire land. Multinational companies are more likely to go through the president, while foreign investors are more likely to go through the Zambia Development Agency.

The latter gives investors institutional support, including certificates of registration giving them access to land. To partner in public investments, the investor goes through the Industrial Development Corporation, a quasi-governmental body that promotes public–private investments. Urban individuals wishing to invest in rural areas are more likely to deal with the commissioner of lands, or approach the chief or local district council directly.

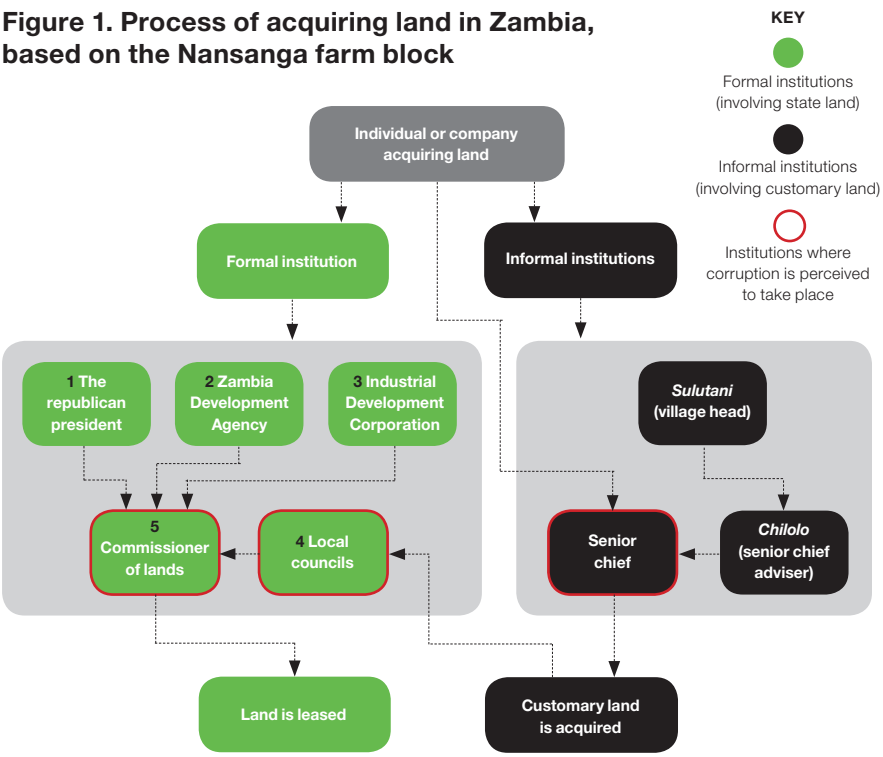
There are therefore three tiers of land administration and governance in Zambia:

- **macro level:** the president, through the commissioner of lands
- **meso level:** district councils contracted by the commissioner of lands to carry out land governance functions
- **micro level:** traditional authorities, dealing exclusively with customary land.

The effectiveness of LSLA deals as development schemes in Zambia has been questioned for the following reasons.

- The interplay between land governance and the outcomes of LSLA deals is marred by party politics, underfunding, understaffing, lack of inter-ministerial coordination and what is locally called cadreism, a form of cronyism characterised by unlawful behaviour by political party sympathisers involved in illegal allocation of land that is nonetheless tolerated. Zambia does not have adequate institutional capacity to manage and govern LSLAs. Consequently, the negative environmental and socio-economic impacts of LSLA deals are more likely to outweigh the positives even if the latter are oversold and the former downplayed.
- The co-existence of formal and informal land tenure systems is a marriage of convenience between the state and traditional authorities. The many ways for acquiring land enable corruption in deals, while the state and traditional authorities have irreconcilable differences of interest in land governance – stalling the formulation of an enforceable national land policy.
- A chronic lack of data plagues Zambia's general land governance structure: not knowing how much land is state-owned and how much is customary land; the monetary value of rural, peri-urban and urban land; the types of investment in land; and the value of investments in land at national level. Because this information is lacking, land markets are not structured and the willing seller, willing buyer model dominates transactions.

Figure 1. Process of acquiring land in Zambia, based on the Nansanga farm block



Note: Local people in Muchinda chiefdom, the Lala, inherit land from their parents or are allocated land by the senior chief who, on payment of a $35 fee, issues a farm book. The book indicates the right to use land, but also that the land belongs to the chiefdom. Non-Lalas approach a *sulutani* who consults a *chilolo*. Land is sought, and if found in the chiefdom, a recommendation is made to the senior chief. If approved, the chief issues a farm book on payment of the fee. To lease land with a title deed, an application is made to the commissioner of lands through a recommendation from the local council. Land for development may need approval from the Zambia Environmental Management Agency and the Department of Resettlement, Office of the Vice-President

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Licence lessons

For nearly 30 years, lethal control of birds designated as pests has been possible under general licences. But last year this came to an abrupt halt – so what happens in the shooting community now?

Caroline Bedell

In April 2019, Natural England revoked three general licences — the legal tools necessary to trap and shoot birds designated as pests — giving only 24 hours' warning. The licences had previously allowed around 50,000 people to shoot 16 species of pest birds, from wood pigeons and magpies to carrion crows.

Chaos ensued, not simply because of the short notice but also because the lack of lethal control left crops and new-born lambs at risk, and birds on the Red List of Threatened Species in peril throughout the breeding season.

The UK licensing system for lethally controlling birds operates under the EU Birds Directive 2009/147/EC, which gives legal protection to all species. The general licences are intended to be a light-touch regulatory tool that allow people to:

- control certain species lethally, to conserve flora and fauna
- prevent serious damage to livestock
- protect human health.

The licences are open, meaning that users do not have to apply for them but do have to abide by their terms.

Since 1992, repeated government reviews have queried whether the licences are necessary or are being used correctly. But it was only when campaign group Wild Justice threatened court action over the perceived illegalities that the system came to a halt. Natural England was advised that the way the licences were issued was illegal, and revoked them with immediate effect.

Members of the British Association for Shooting & Conservation (BASC) were up in arms, taking thousands of enquiries in the aftermath of the decision, and along with farming bodies, conservation organisations and pest control businesses, it issued a firm response to Natural England.

The agency initially tried to accelerate the process of a separate licensing system known as individual licences and launch several general licence replacements. However, the individual licences were slow to be issued and the general licence replacements contained a number of errors.

Further condemnation followed. Such was the impact of the criticism that the then environment secretary Michael Gove took the licensing process back from Natural England and brought it under his control at the Department for Environment, Food & Rural Affairs (DEFRA).

In July, DEFRA reintroduced a set of temporary general licences that expired in

Did Natural England have to act so peremptorily at a critical time of year, when the general licences are heavily relied on?



Some of the bird species that were designated as pests include, from left to right, magpie, crow and woodpigeon

February 2020 but have since been renewed until 31 July. While by no means perfect – there continues to be concern over the use of the licences on EU-designated sites and the implementation of 300m buffer zones around them – this regime has provided some stability for people who need to use general licences.

The devolved governments of Scotland and Wales and their licensing agencies also reviewed their general licence systems. They have consulted to different levels and have reissued revised licences.

As we await DEFRA's findings and long-term solution, along with seeing what measures the devolved governments will take, we should think about how to avoid similar problems in the future.

Future of licences

Once the challenge from Wild Justice came through, Natural England took legal advice and believed it was acting unlawfully by re-issuing the general licences in the format it had been using. The agency, along with other government bodies, would have come in for significant criticism for fighting a legal case it was unable to defend, especially as its finances were and continue to be under considerable pressure.

In 2015, a Law Commission report that recommended reforming the Wildlife and Countryside Act 1981 also raised concerns about the licences, saying that 'they require licensees to make scientific judgements that the licensing authority should be making itself before the licence is granted.'

This being the case, did Natural England have to act so peremptorily at a critical point of the year, when the general licences are heavily relied on? Why did it not take forward the Law Commission's recommendations and rectify the situation in a sensible timeframe? What do we expect from the new licences once they are published in August?

The department understands the requirement for making the licences easy to follow: it has to be on the right side of the Birds and Habitat Directive, which is closely replicated in the 1981 Act, while simultaneously ensuring that lethal control can, where necessary, continue.

BASC is trying to ensure that scientific evidence and practical experience will form the basis of the licences by attending round-table forums and direct contact with the agency. While we seek a fit-for-purpose system, we are also clear that the pests list needs to remain flexible so that species can be removed or added. That means the list should be regularly reviewed.

BASC also remains concerned about the way the licensing system will operate on EU-designated sites, and the proposed 300m buffer. It appears that the individual licences allowing lethal control in these areas are not going to be straightforward to obtain, putting the protection of species of conservation concern at risk.

While DEFRA, Natural England and the devolved governments have retained the principle and practice of a general licence, changes may be made. There is no doubt that future licences published by DEFRA will be amended; species could also be removed from the general licence, and more onerous conditions may be introduced around the timing of its use. It may even become a requirement that shooters provide records of the numbers and types of pest birds they have killed.

Wild Justice has started a judicial review on whether the release of game birds into the countryside could be considered a plan or a project under the Conservation of Species and Habitat Regulations 2017, and its pre-action protocol letter of 20 January suggests a 5km buffer be implemented around all EU-designated sites as a way for DEFRA, Natural England and Welsh Assembly ministers to meet the precautionary principles.

Next steps

The legal challenge will show whether releasing pheasants is a plan or a project requiring a habitat regulation assessment (HRA). Should an HRA be required, and that finds release of game birds is having a negative impact, Wild Justice will no doubt ask whether UK laws are strong enough to manage this. Science will play a huge part in assessing whether there is damage to the EU-designated sites, the size of any buffer zone, and what other steps should be taken.

BASC's declared mission is to enhance the environment through sustainable shooting. This is important for farming and many other sectors, so we must show:

- that shooting fits into the UK's environmental agenda
- how to prevent illegal shooting of raptors, sustain quarry species populations, and ensure appropriate ammunition is chosen
- how shoots can enable a net gain for the environment and possibly net-zero emissions in the future.

The shooting community should ensure that its activities are an asset to the environment. With more focus on this than ever before, we must be both progressive and realistic in our outlook.

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Related competencies include:
Legal/regulatory compliance, Management of the natural environment and landscape

Drone shot showing a 20MW gas genset scheme

Energy opportunity

To achieve its pledge of net-zero emissions by 2050, the UK will have to scale up investment in clean energy sources and storage – which opens plenty of opportunities for landowners

Hugh Taylor

The opportunities for developing an energy scheme on land are greater now than ever. Schemes from 2MW to 50MW are potentially viable, whether it's a 0.1ha site housing a gas genset scheme – comprising reciprocating engines that burn gas to generate electricity – connecting to the grid at 11kV, or solar panels on 15ha connecting at 132kV. Wind and battery storage can provide good opportunities for landowners as well.

When considering energy schemes, landowners can fall into one of three categories.

- **Landlord:** in the most common arrangement, the landowner serves as the landlord for an energy scheme and receives rent for hosting it. This presents a reliable source of long-term revenue for minimal financial outlay and risk. Landowners should be mindful of any tax implications, though, and ensure they are adequately protected from legal and professional fees connected to the scheme.
- **Self-developer:** an entrepreneurial landowner can secure the holy trinity of project rights – grid, planning and land rights – with the latter already in their gift. Selling this bundle can attract high financial rewards, but requires a significant outlay in grid, planning and professional fees. Compared to merely seeking a long-term energy tenant, this is a high-risk approach.
- **Owner–operator:** the landowner secures the project rights, funds the construction and then owns and operates the scheme for the long term. This option requires the biggest financial commitment, and the relatively skinny returns on investment are not for everyone. The greater exposure to energy market risk inherent in subsidy-free solar schemes can be mitigated by securing long-term revenues from power purchase agreements (PPAs). PPA terms can be as long as 15 years, which is equivalent to the length if not the value of the historic feed-in tariff (FiT) and Renewables Obligation (RO) incentives that drove site acquisition markets until mid-2015.

There are good, long-term reliable returns to be had, but anyone considering these routes should take independent, expert advice. Anyone selling land should also consider energy opportunities that represent a higher-value use. Land prices can be significantly higher where the proper prerequisites for a project have been established. Whether buying, selling or acting on behalf of a client, carrying out due diligence is important – including an energy project feasibility study – because failure to do so could cost millions of pounds.

The technology options

The end of the FiT and RO in 2015 killed the solar market. But the cost of solar photovoltaic panels themselves has more than halved, and wholesale energy prices have soared by up to 60 per cent since then. Solar operators are increasingly securing PPAs with large corporate organisations, and the amount of clean energy secured

this way in 2019 was up more than 40 per cent from the previous year's record, according to Bloomberg New Energy Finance.

We're now seeing developers focus predominately on large-scale solar, keenly seeking sites with good grid and planning prospects of 15–80ha in size. Depending on their site, and, in particular, the cost of the grid connection, landowners can expect ground rents of more than £1,975 per hectare for solar leases of 30–50 years.

Another technology option is gas gensets. Flexible schemes such as these can be switched on quickly, and without them we would be seeing many more blackouts like those of August 2019 or paying more for our electricity. Batteries helped to keep the lights on for about half an hour when the Beast from the East hit in February 2018, but gas gensets helped see us through the harsh weather.

Gas gensets can return up to £150,000 per year. A typical project requires around 0.2–0.8ha of ground and proximity to the gas grid, which needs to be at a suitable pressure and diameter for the size of scheme. As gas gensets are noisy they should be more than 100m from any dwelling. Existing background noise such as traffic, industrial activity or quarrying will help mitigate planning risk. Distribution network operators (DNOs) must have the capacity to maintain their network fault current within statutory limits, which is higher for gensets than for battery storage or solar schemes.

Feverish activity in battery storage around four years ago subsequently cooled in response to an oversupply of schemes in National Grid's frequency response markets. This depressed the revenues achieved in the grid's monthly auctions, and also coincided with a sharp reduction in capacity market revenues for storage schemes. However, the markets and associated revenues are now recovering, albeit gradually – and the cost of lithium-ion technology continues to tumble year on year – so good battery storage sites can attract more than £50,000 per year. Globally, storage deployment is expected to increase over a hundredfold by 2040, with the UK being in the ten countries leading this charge.

A typical battery storage scheme occupies up to 0.8ha, comprising multiple 12m shipping-style containers. Like gensets, storage schemes won't be suitable on all parts of the network; unlike other technologies, storage requires symmetrical import and export capacity to discharge and charge cells. Voltage step-change issues also preclude battery schemes on many parts of the grid.

Of course, any opportunity for any technology starts with the local electrical network. Proximity to the local DNO's assets is important. The best sites are close to a 33kV circuit or have a primary substation, typically 33kV/11kV, a bulk supply point, typically 33kV/132kV, or grid supply point, typically 400kV/132kV, nearby. However, smaller schemes – typically up to 8MW – are better connected at 11kV and ideally, but not crucially, less than 1km from a primary substation.

Yet proximity to the right hardware is the simple part – connecting successfully to any given circuit can be very complex. Different technologies have specific grid requirements, and many opportunities depend on flexible connection arrangements such as active network management and export limitation schemes. All applications must also adhere to new and more stringent G99 engineering standards issued by the Energy Networks Association.

From April 2018, each grid connection application also costs up to £8,000. As an example, Electricity North West alone saw 80 per cent of applications to connect large-scale schemes to its network fail in 2019. Before you submit your application, ensure that your information is based on thorough, expert network studies – and close liaison with the DNO – for the right technology at the right scale for the right part of the network, to avoid paying repeat fees.

How to maximise your chances

There are many factors to consider other than the grid, not least access, wayleaves and easements, and planning considerations such as existing use, visibility, noise, landscape or habitat designations and flood risk. In addition, there are other important factors if a scheme is to be successful. The following tips and hints can help you start if you are thinking of getting into energy schemes.

- **Don't sign up to the first developer:** there has never been a more appropriate time to be prudent and avoid signing up with the first developer that knocks at your door. As scheme developers specialise in specific technologies, scales and voltages, a hasty approach is likely to leave landowners with no scheme at all. If a landowner lets a developer apply for a grid connection for their specialist technology and scale, it's likely to be wrong for the site's specific grid connection opportunity. Furthermore, a landowner should avoid having a grid application submitted in a developer's name and the grid offer, which is the key to a scheme, should be secured independently. The landowner can then attract competing bids from among the best developers for their specific technology and scale. This approach will also put the landowner's representatives in a position to negotiate optimal terms.
- **Don't be put off by an historical lack of grid capacity:** the capacity to export and import electricity to and from the grid is limited, but it is also changing all the time. Failed projects are releasing capacity and DNOs are reconfiguring and reinforcing their networks, and increasingly monitoring them in real time to enable more connections.
- **Don't delay or deliberate:** DNOs issue spare capacity on a strictly first-come, first-served basis. If there is capacity on part of the network, it will only be enough for one scheme. Once you as a landowner have done your due diligence and are sure you want to go ahead, you must act fast to get ahead of your neighbours.
- **Do get independent and expert advice first:** poor grid advice can lead to missing out on a scheme. It's vital to get expert, independent advice early by commissioning an assessment of the site and its grid prospects before making any commitment to grid application, planning and legal costs. The need for thorough grid expertise and in-depth technical, commercial and market knowledge is greater than ever, not only to make an appropriate grid application but also to see a scheme through to completion.

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Related competencies include: Energy and renewable resources, Land use and diversification

How to build the perfect city

Fast-evolving smart-city technology can help developers and planning professionals make the best decisions about the built environment

Jason Hawthorne and Gordon Ingram

Land is at such a premium in our major cities that identifying and making the most of opportunity areas is more important than ever before. But smart-city platforms are for the first time enabling us to combine complex mass data sets to inform and shape the built environment. As this technology evolves, the possibilities for the planning profession are limitless.

The opportunities on any site are determined not only by its physical boundaries but numerous factors including technical constraints, environmental considerations and layers of planning policy. Seeing these boundaries is often the key to ensuring a scheme's success.

Historically though, that has not been easy. Simply comprehending the physical boundaries of a site for example has depended on two-dimensional plans that may not be accurate. This makes schemes costly and entails time-consuming testing of proposals against criteria that are rarely visible side by side.

Smart-city and planning technology platforms are already altering this process, enabling developers and local authorities to understand schemes more clearly. A key factor is the ease of access this technology offers to mass sets of data: platforms can provide an interactive 3D map of entire cities, accurate to within 15cm, including all current and consented schemes. Users can input their proposals and assess their impact from any viewpoint in the city in seconds. Mapping a site to understand its physical boundaries can be done quickly, accurately and easily, and the context can also be viewed alongside the current and future environment.

But perhaps the most exciting prospect for this type of technology is the ability to combine multiple data sets in one location — incorporating, for example, traffic flows, daylight and sunlight assessments, protected views, local plans, wider planning policy and environmental impacts. Project teams can test their schemes against these factors in one place, and the constraints in which they must work are transparent.

Creating mass data hubs

Evolving data hubs combine these multiple, complex data sets about buildings, cities and even entire regions. Compiling this information in one place and making it transparent and accessible naturally promotes improved design and build — there is less need for sacrifices on a particular build when we can test viable alternatives quickly.

Because parameters can be assessed so easily, we also encourage collaboration city by city. For example, pedestrian flows across New York could be assessed against those in London and, if one is performing better than the other, developers and city planners might ask why and use that insight to improve the streets. The same comparisons could be made for environmental performance or the impacts of development on daylight.

We can look across an entire city and establish where the opportunities are and what the best use of those sites may be, given all the relevant factors. More than that, we can quickly assess the limitations on that site — are there protected views, for example, or traffic or environmental implications? What type of development would work there? How would it compare to what exists and what is coming forward on nearby sites? Much of this information is already available, but accessing it is costly and time-consuming.

Perhaps the most important principle in this new age of mass data sets is transparency. The planning system tends to be inaccessible to those outside the sector because of the complex way in which information is presented. Environmental impact assessments that run to hundreds of pages, long transport assessments and detailed descriptions of schemes in complex planning jargon deter the general public from reading even what they can access.

Smart-city technology instead enables complex information of this type to be presented simply using visuals and data. Some smart-city platforms make it possible for users to take a virtual tour of a site, and taking a 'walk' around a scheme that is accurately represented in its surroundings means that impacts on neighbouring buildings can be easily seen and understood and images of proposed schemes extracted. Real-time demonstrations will clearly show the proposed impact on traffic and pedestrian movements, allowing users to see the change rather than simply reading the figures in a technical report.

This transparency can improve working relationships between the development sector and local authorities. The technology acts almost as a trustworthy mediator through which the developer can be sure the local authority's policies are being accurately represented, and the authority can rely on the representation of the proposed scheme. Smart-city technology in planning is about helping professionals to make the best decisions about what should be built and where. But as they evolve, the platforms we use to embed these mass data sets will start to become a blueprint of how to build the perfect city.

View towards Canary Wharf demonstrating changing development across the capital: the yellow buildings demonstrate all major consented schemes, and the blue, consented schemes under construction

This technology can make planning and design quicker, more streamlined and cheaper for everyone involved, and lead to smarter regulation based on a wealth of accurate data, so we can make better decisions about where housing, schools, GP surgeries and so on should be built.

As site boundaries become easier to see and understand, the number of irrelevant objections to a proposal should be reduced, and planners should be able to handle a greater number of schemes that they can assess at the first go because they have met the relevant criteria throughout the process.

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Case study

The City of London's planning team was looking to identify opportunity areas for development in what is already one of the capital's most densely developed boroughs. In such a central location, the only obvious opportunity that remained was to go upwards, so the team looked for sites where height could be most appropriately increased.

One of the biggest restrictions was the decades-old protection on views of St Paul's Cathedral, limiting the height to which certain corridors could be developed. The borough had previous issues with plans for developments that infringed these views, but could not easily or accurately see the boundaries for these restrictions. This made mapping the true potential of the City a near impossible task.

Using VU.CITY, however, the planning team can review all the accurately mapped protected views of St Paul's. The 3D, interactive model of the City allows them to identify easily projects that would have an impact on the protected views. This visual representation of the upper building limits has enabled the team to understand the scope for future development in the borough and suggest how the height of schemes might be increased to make full use of the site in permitted developments. The planning team will in future be able to make the best use of sites while protecting the important heritage of views that may otherwise come under pressure from developers.

Troubled waters

Farming in the UK relies on a secure water supply. How can farmers make the best use of limited resources?

Dr Nicola Dunn

With hot summers like 2018 now more likely than in the last decade, demand for water in UK agriculture and horticulture could be set to rise. While the Farm Business Survey (*bit.ly/FarmBizSurv*) indicates that most UK farms have a mains water supply, depending on the type and location of farm other sources are also used, as detailed in Figure 1.

Less mains water is used in the uplands, being more remote, so farmers rely on rivers and streams. Dairy farms use boreholes, as do those rearing pigs or poultry and horticultural businesses growing fruit, vegetables and ornamental plants. Rainwater storage is used in protected horticulture, for instance in glasshouses, mostly because they are in areas of low rainfall. Wherever used, mains water is the most expensive and highest quality due to drinking water standards — a key consideration for horticultural and dairy businesses, where potable water may need to be used to protect consumers.

Livestock accounts for around half of agricultural water demand nationally, including drinking water as well as operations such as cleaning. The 2018 drought was therefore challenging for livestock farming in areas that had been previously unaffected by shortages, because streams ran dry and there was a lack of other water sources. Such farms are also vulnerable to supply disruptions in the winter when frozen or burst pipes can regularly cause problems, posing a potential welfare issue.

In crop farming, water is primarily used for potatoes and horticulture. There is a large trade deficit in horticultural produce, and the UK relies particularly on imports of fruit. However, the country is almost self-reliant in potatoes, and exports around 100,000t of seed potatoes to countries such as China and Egypt, which value the crop for its quality and low disease risk. Would it be possible to increase production, reduce trade deficits and increase exports? If so, what limitations would water place?

Agriculture uses less than one per cent of abstracted water in England, which seems an insignificant amount (*bit.ly/UKwtrabs*). However, water used on farms isn't returned to the catchment, and in some areas, agricultural abstraction of surface water can have a significant impact on river flow during the summer months. There are currently around 10,000 licences for spray irrigation, representing about 90 million cubic metres used annually, with variation for weather fluctuations.

Around half the UK potato crop is irrigated according to the Agriculture and Horticulture Development Board (AHDB), around 10,000ha less than the 2005 baseline. While growing without irrigation is possible, depending on location and market, there could be pressure on production in some years. If rainfall is lower than average this could affect crop quality and yield. Irrigation in the early season reduces the risk of the potato defect common scab.

The rain gun is still the most commonly used technique for applying water in field vegetable and potato growing in the UK. Other techniques such as sprinkler, boom and drip irrigation could improve the efficiency of water use, and these can be integrated with scheduling and monitoring software to help inform decisions on irrigation. The AHDB is working to demonstrate differences in water use and marketable yield when using different techniques, and hopes to do more in future to help farmers share their learning about irrigation and water management techniques.

Water abstraction

The Environment Agency (EA) has assessed the availability of water for abstraction, and important fruit- and vegetable-growing areas are shown to have little opportunity for more abstraction licences. Future water availability and ensuring that food can still be produced in these areas will be of increasing importance.

Climate projections published by the Met Office in 2018 indicate that hot summers are expected to be more common and, if combined with lower summer rainfall, crop water needs would have to be met through increased irrigation — but there may be no more water available to licence. The threat to UK production is increasing, and the Met Office suggests that the likelihood of hot summers such as that of 2018 is now ten to 20 per cent when it had been less than ten per cent.

Farmers and growers are certainly aware of this long-term threat to their businesses and trying to manage the situation. In particular, farmers are worried about the loss of headroom in licences during the renewals process, being the extra amount of water allowed for production in dry years, which may not always be needed.

The EA is concerned that if full licensed volumes were used during times of drought, when farming needs are greatest, this could be to the detriment of river ecology. Headroom on licences may therefore be reduced to manage the risk to the environment, but thereby increasing risk in agriculture. Cranfield University has developed a tool called D-risk to help farmers evaluate their licences against the potential for an irrigation deficit and to check existing headroom (*d-risk.eu*); there is also a tool to investigate the costs and benefits of creating a reservoir.

Licence to grow

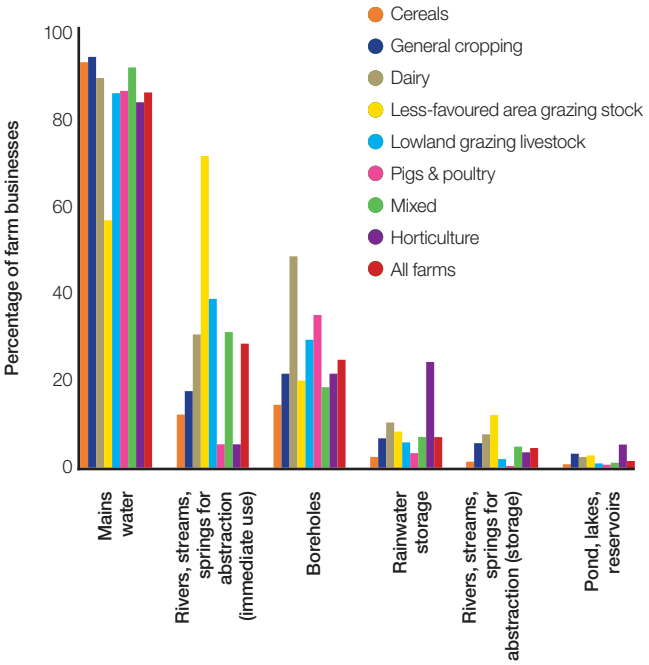
Agricultural abstraction licences do not guarantee supply either — for instance, in the event of restrictions. Hands-off Flow restrictions are used throughout the season to stop abstraction when river flow levels drop (*bit.ly/HoffFlow*). Restrictions on spray irrigation under section 57 of the Water Resources Act 1991 can also be used during the growing season to limit access to licensed water at times when the environment could be affected by low river flows, and are a problem for growers who abstract from surface waters. Back-up supplies from groundwater or reservoirs are among the measures businesses can take to improve resilience.

Reservoirs and rainwater harvesting are increasingly common in the horticultural sector, and have greatly improved the water security of businesses. By storing water in a winter-filled irrigation reservoir farmers are able to avoid restrictions on irrigation during summer, and it also means agricultural impact on summer river flows is reduced. These measures help farmers get through dry years; however, they are expensive, costing tens or hundreds of thousands of pounds, with limited financial support available and various planning, technical and management requirements.

The AHDB WeatherHub takes weather data and integrates it with pest and disease forecasting alerts to enable farmers to make management decisions. The board is also looking at ways of integrating this with other open data sets such as drought forecasting to help farmers anticipate unexpected events such as the 2018 drought and the Beast from the East.

While there are opportunities to increase UK-grown fruit and vegetable production, this needs a secure water supply. There are big challenges, not least our weather and pressure from all sectors on limited water sources. The strategies discussed above can help farmers make best use of the available water, supported by effective policy and uptake of technical innovations.

Figure 1. Water sources on farms



SOURCE: FARM BUSINESS SURVEY

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Further information: The AHDB is funded through a statutory levy on farmers, growers, and others, and provides resources and guidance for the sector (*ahdb.org.uk*).

A buoyant housing market

Confusing legislation is a stumbling block for bringing new-build floodproof housing to the UK – as one company's experience attests

Justin Meredith

Q: First of all, what is the legal status of a house that can float? Is it considered a fixed asset?

JM: Yes, it is a fixed asset that is capable of attracting a traditional mortgage and insurance cover.

There are two types of floodproof building: those on stilts that are always above the predicted flood water level, and those that can float if the surrounding area becomes flooded. The habitable floor is always above the water level with no risk of being exposed to flooding internally. We are proposing houses that sit dry but can float in the event of a flood. A fully floating house has a completely different status because it has no terra firma below it.

Q: Should you be trying to persuade councils to build in areas that are at risk of flooding?

JM: We have been lobbying government for two or three years. In terms of engineering, principle and process, floodproof homes could be introduced straightforwardly on to the UK market; but there's a lack of understanding, and conservatism about bringing it to the UK.

It starts with the National Planning Policy Framework (NPPF) and cascades down through local authorities who are the decision-makers. They rarely look at these types of house positively. Some councils that have major flood problems look more closely but they are constrained by the NPPF, and in particular by the wording of the sequential test, which directs all new development to the area of lowest risk.

Decision-makers should be allowed to accept the appropriateness of the proposals. *Rising to the Climate Crisis: A Guide for Local Authorities on Planning for Climate Change* (*bit.ly/TCPA-ClimCris*), published in May 2018, states that the application of the sequential and exception tests should include consideration of design innovation.

Q: Can occupiers be confident that the mitigation measures work when there are so many extreme flood events?

JM: We operate in a sophisticated economy, we have the best modelling in the world, and we know where the water goes when it arrives. Understanding flood extent and limitation, we can be confident that the technology works. Under current legislation, we have to model and plan for a one-in-1,000-year event, which is an extreme storm. But a floodproof home can survive any storm condition no matter the severity because it just continues to rise.

Q: What are the cost and value implications? Are there additional costs and, if so, are they matched or exceeded by the additional value of a floodproof home?

JM: Floodproof homes are more expensive to build and infrastructure costs are likely to be higher. These additional costs are all reflected in the land value, which will necessarily be lower.

Q: What's the position with the two planning applications you've made?

JM: We were in the planning stage for two floatable homes in Dorset, which the Environment Agency passed as safe.

Floodproof homes at Medemblik: the Netherlands inspired the creation of floatable homes in the UK

But they failed the sequential test for no discernible technical reason, even though the buildings were adapted to cope with river flooding as well as sea-level rise. This was disappointing because it was a landmark development on a brownfield site in Christchurch. The scheme is being reviewed and we will resubmit the proposal. But this is costly, so clarity about the way the sequential test is applied is necessary.

Theale was a scheme that had wider community benefits. It was a hybrid scheme, with 200 conventional houses, 25 floodproof houses and a new sailing club and water-based activities, with a flood alleviation scheme for the local village that would reroute water into an 80ha lake.

But we were refused in planning.

The floodproof homes were accepted and considered good, but the conventional homes were not. We appealed, but the Environment Agency intervened and rezoned the conventional part of the site from flood zone 1 to a functional flood zone 3b. We had to withdraw as we can't — and would not want to — build conventional housing in the floodplain. We are currently reviewing the flood map to test its accuracy following such a significant change.

Q: Have the designs been tested against the Building Regulations?
JM: Yes, everything is designed with the Building Regulations in mind. The designs are borrowed from Dutch building techniques and lend themselves to modular or structural insulated panels (SIPs) methods of construction, conforming to the highest building standards. The substructure or buoyant bases are made of concrete, while the upper floor is of a lightweight construction — the heavy basement provides stability to the building when it is in a raised position.

Q: What is the main construction type?
JM: The substructure is a buoyant basement made of a waterproof mix of concrete that needs to be poured in one go to ensure there are no joins. It's not a complicated process, and has been carried out for many years, especially offshore.

The superstructure is not suitable for the traditional wet-trade method of construction using bricks but it is ideally suited to off-site construction using the modular or SIPs approach to building and the same as for any other modular-type building construction elsewhere.

Q: Do the piles require special maintenance? And how does the building's lifespan compare to that of buildings not designed to withstand occasional flooding?
JM: The piles are fixed, and the building moves up or down rather than horizontally. In the UK, we are talking about living from the ground floor and above, which is above flood level. The structure of the basement is also damp-proofed. It is almost the same principle as a pontoon, tethered to the pile through spring-loaded rollers or dolphin structures. Only the rollers require any substantial maintenance.

There are buildings in the Netherlands where more modern superstructures have replaced the originals while retaining the buoyant basement. Insurance requires a maintenance and testing programme, for the basement in particular.

Q: Have UK insurers been approached about this construction type? And what are the expected premium uplifts from comparable standard construction?
JM: The first thing I looked at was whether I could sell can-float buildings as if they were traditional houses. After all, this is planning for a one-in-1,000-year event and the buildings may not rise in our lifetime. At present it is a niche product, so it will attract a small premium — which is ironic considering it will be floodproof. Then it's about constructing a sufficient number to become a mainstream product.

Q: What role is there for chartered surveyors in these types of project?
JM: There are important functions for RICS here. One is to give confidence to lenders that this is an accepted building technique and two, to reassure them that valuation will be maintained and that their investment is secure.

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Related competencies include:
Planning and development management, Spatial planning policy and infrastructure, Valuation

RICS' view

The two key areas identified by Justin Meredith where surveyors have an important role relate to all our responses to climate change, not just flooding. Few people think we can deal with these problems without new construction materials, designs and methods, as well as new ways of managing commissioning and supply chains to verify that what is being built is as specified. So the profession must assure anyone relying on our advice that evolving technical standards accord with existing regulation – but regulations may also need updating to accommodate innovation.

Reassuring lenders will, however, be more challenging. If an innovative building is a niche product but highly desirable, it may sell at a premium to similar but not so distinctive properties. If however homebuyers prefer more traditional properties, it may sell at a discount. The valuer should give an opinion that considers all such factors; but the more transaction evidence there is, the more assurance they can give lenders about their security. It is also important to be aware of legal rights associated with natural watercourses where relevant (*bit.ly/watercourseresp*).

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